

REMARKS

Claims 1 - 15 are pending in this application. By this Amendment, claims 1, 6 and 11 have been amended. The applicants respectfully submit that no new matter has been added. It is believed that this Response is fully responsive to the Office Action dated September 26, 2001.

Allowable Subject Matter:

Applicants gratefully acknowledge the indication in the Office Action that claims 2-5, 7-10 and 12-15 would be allowable, if amended, to overcome the outstanding indefiniteness rejection under 35 U.S.C. §112, second paragraph, as well as include all of the limitations of the base claim and any intervening claims. However, for at least the reasons outlined below, applicants respectfully assert that all of claims 1 - 15 are allowable.

Drawings:

The drawings stand objected to in item 1 of the outstanding Action under 37 CFR 1.83(a) in view of the Examiner's position that the method for producing the plane diffraction grating including the steps of coating, covering, etching and rotating recited of claim 11 are not show in any of the figures.

Although Applicants believe that present Fig. 4 explains the method of claim 11, new figures Figs. 4A - 4C are provided.

35 U.S.C. §112, Second Paragraph Rejection:

In item 3 of the Office Action, claims 1-5, 6-10 and 11-15 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

This rejection is respectfully traversed.

Applicants respectfully submit that the amendments to claims 1, 6 and 11 overcomes the rejection of claims 1-5, 6-10 and 11-15 under 35 U.S.C. §112, second paragraph. Accordingly, withdrawal of the rejection of claims 1-5, 6-10 and 11-15 under 35 U.S.C. §112, second paragraph, is respectfully solicited.

Moreover, the Examiner contends that the phrase “rotational position of the area” recited in claims 1, 6 and 11 and the phrase “the rotational position . . . about a rotational center as a foot of the rotational axis on the surface” recited in claims 1 and 6 and the phrase “the rotational position of the area about a rotational center” recited in claim 11 appear to be vague and indefinite.

However, the Examiner’s position is overcritical since the angle \varnothing between the normal to the meridional plane (which includes the incident ray, the point of incidence 30 and the diffracting ray) and the z axis defines the rotational position of the diffraction grating 3. The original position of the rotation ($\varnothing = 0$) is defined as the position where the grooves are perpendicular to the incident ray or

perpendicular to the meridional plane. For example, the rotational position \emptyset of the elongated area R2 about a rotational center 32 defined as a foot of the rotational axis 31 on the surface is shown in Fig. 2.

In addition, the Examiner asserts that claim 1 further recites that the rotational axis is normal to the surface; this implies that the rotational motion of the grating with respect to the axis could be either restricted on the plane of the grating in azimuthal direction or in an angular direction that perpendicular to the plane of the grating. it is therefore not clear which rotational motion is referred here. Please see lines 20-23, page 2 of the outstanding Action.

However, the Examiner's comments are overcritical since the normal to the surface is disclosed in the present specification as concerning the azimuthal direction.

Further with regard to claims 6 and 11, the Examiner asserts that the term "the rotational axis" of claim 6 lacks antecedent basis and the term "rotational center" of claim 11 is undefined. Claims 6 and 11 have been amended to overcome such deficiencies.

With regard to the Examiner's rejection of claims 2-5, 7-10 and 12-15 with respect to the term " \emptyset " each of the independent claims 1, 6 and 11 are amended to include the term " \emptyset ".

In addition, the Examiner argues that the phrase "an original line" recited in claims 2-5, 7-10

and 12-15 also appears to be vague and indefinite since such line is not definitely defined. it is noted that such original line must be definitely defined in order for the angle \varnothing to be definitely defined, since for a rotatable plane such as the diffraction grating plane one can arbitrarily choose any line as such original line and if so the functions would have no meaning since the values of \varnothing will be arbitrary. Such indefiniteness makes the scope of the claims unclear.

However, the Examiner's comments are overcritical since each of claims 2 - 5, 7 - 10 and 12 - 15 define the position of the original line where the rotational position \varnothing is equal to zero.

Further, with regard to claims 3, 5, 8, 10, 13 and 15, the Examiner takes the position that the claims fail to explain why the wavelength of the light diffracted from the original line is different from the wavelength of the light diffracted from the area along the line different from the original line. In particular, for claims 5, 10 and 15 dependent from claims 4, 9 and 16, the wavelength of the light diffracted from the area along the line are different from their respect base claims 4, 9 and 14 for the same grating groove area, which makes the claims in error.

However, the Examiner's comments are overcritical since the diffraction efficiency is maximized at the position when \varnothing is equal to zero.

As To The Merits:

As to the merits of this case, the Examiner sets forth the following rejections:

- (1) claims 1 and 6 stand rejected under 35 U.S.C. §102(b) as being anticipated by **Hasegawa et al.** (U.S. Patent No. 5,861,964); and
- (2) claim 11 stands rejected under 35 U.S.C. §103(a) as being unpatentable over **Hasegawa et al.** in view of **Ohkura et al.** (U.S. Patent No. 5,238,785)

Both of these rejections are respectfully traversed.

Applicants acknowledge that **Hasegawa** teaches a rotatable hologram having grating formed on the surface wherein the hologram is rotatable about an axis normal to the plane surface of the hologram with the spatial frequency of the grating dependent on the aximuthal angle of the rotation.

Hasegawa, however, does not disclose a rotatable hologram that has a grating groove whose profile at a radial area is determined depending on a rotational position of the area about the rotational center. Since there is no mention of grooves in **Hasegawa**, it is possible to construct the rotatable hologram to have a parallel pattern whose transparency periodically changes at a preset spatial frequency. In this case, the grating pattern cannot have any profile. In the present invention, on the other hand, the presence of grooves on the surface of the grating is essential.

Further, Hasegawa's rotatable hologram plate 802 is used to scan the light beam from the light source 801 onto the image formation surface 804 to form an image on it. Such use is quite different from that of the present invention in which the diffraction grating is used to separate a ray into the component colors. As describe in col. 52, line 39 - col. 53, line 32, the incident light to the hologram plate 802 is a laser which cannot be separated into colors.

When the rotatable plate 802 is used, as indicated by its name, it is rotated at high speed. The diffraction grating of the present invention may be rotated at a low speed in a wavelength scanning, but it is not rotated more than a certain angle less than 360 . Thus, the present invention is not obvious over the cited prior art documents.

Thus, for at least these reasons, it is respectfully asserted that the prior art fails to teach or suggest recitations of claims 1, 6 and 11, and request that the Examiner allow these claims, along with the entire application, to issue. Accordingly, withdrawal of the rejection of claims 1, 6 and 11 under 35 U.S.C. §102(b) and §103(a) is respectfully solicited.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE".

If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

AMENDMENT

U.S. Patent Application Serial No. 09/642,883

In the event that this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees which may be due with respect to this paper, may be charged to Deposit Account No. 01-2340.

Respectfully submitted,

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Enclosures: Version With Markings To Show Changes Made
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VERSION WITH MARKINGS TO SHOW CHANGES MADE**IN THE CLAIMS:**

Claim 1, 6 and 11 have been amended as follows:

1. (Amended) A plane diffraction grating with grooves formed on a surface thereof, the plane diffraction grating being rotated about a rotational axis which is normal to the surface, and being characterized in that a profile of the grooves at a radial area is determined depending on a rotational position \varnothing of the area about a rotational center defined as a foot of the rotational axis on the surface of the plane diffraction grating.

6. (Amended) An optical system comprising:

a plane diffraction grating having grooves on a surface of the plane diffraction grating whose profile at an area is determined depending on a rotational position \varnothing of the area about a rotational center defined as a foot of [the] a rotational axis [defined below] which is normal to the surface;

a mechanism for rotating the plane diffraction grating about [a] the rotational axis [which is normal to the surface];

an incidence optical system for casting a converging beam of light on a point of the surface of the plane diffraction grating, the point being apart from the rotational center.

11. (Amended) A method of producing a plane diffraction grating having grooves on a surface thereof whose profile at an area is determined depending on a rotational position Ø of the area about a rotational center defined as a foot of a rotational axis, the method comprising the steps of:

coating a substrate with a photo-resist layer and forming a photo-resist mask from the photo-resist layer according to a preset pattern of groove arrangement;

covering the photo-resist mask with a sector mask having an opening of a narrow sector whose apex is set at the rotational center;

etching the substrate over the sector mask with an appropriate etching condition depending on a rotational position of the sector mask about the rotational center;

rotating the sector mask by an angle of the apex of the narrow sector; and

repeating the etching process and the mask rotating process until the narrow sector sweeps the surface of the substrate.